

Pallets: A Growing Source of Recycled Wood

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Abstract

Considerable volumes of solid hardwoods, solid softwoods, and wood panels are used to manufacture pallets and containers in the United States. Increasing quantities of these materials are recovered from the waste stream for reuse and recycling. Two important groups involved in this recovery and recycling are firms in the pallet industry (SIC 2448) and landfill operations (municipal solid waste landfills and construction and demolition waste landfills). Firms in the pallet industry received an estimated 83.3 million pallets for recycling in 1993. Municipal solid waste landfills processed approximately 880 thousand tons of pallets in 1995. At construction and demolition waste landfills, approximately 162 thousand tons of pallets were processed. Ground pallet material is used to produce mulch, bedding, compost, soil amendments, and fuel. Products with building and construction applications include particleboard, fiberboard, cement board, insulation board, and wood-plastic composites. Strip flooring holds perhaps the greatest potential as a high value-added product from pallet wood.

Introduction

Many manufacturers of wood-based products are seeking additional sources of raw materials. This search has, in some cases, led to the use of materials diverted from the waste stream. The paper industry, for example, has been quite successful in using recycled fiber.

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The average recovery rate for paper and paperboard was reported to be 39.2 percent in 1993 (1).

The overall rate of solid wood recovery from the waste stream, while below that of paper and paperboard, is increasing (5). One product that is currently recovered and holds potential for increased recovery is the wood shipping pallet. Large volumes of wood are used to manufacture pallets and several factors favor the recovery of this material:

- collection is aided by the tendency for pallets to accumulate in urban areas
- pallets can be disassembled easily and most of the component parts can be reused
- many pallets contain standard-sized parts
- repairs using metal plates can restore the strength of the pallet to levels equal to or greater than when new
- ground or chipped pallet wood has properties that allow it to be used in a variety of products
- used pallets are available in ample quantities

This paper reports on several aspects of pallet recovery and recycling. ¹A description is given of volumes and types of new wood used to manufacture pallets and containers in the United States as this

¹The term recycling is used in this paper to designate those activities that result in the reuse of a pallet or the wood in a pallet. These activities include: inspection and reuse; repair and reuse; chipping for mulch, animal bedding, and furnish; and use as fuel. Activities that result in no useful output (e.g., landfilling, burning without capturing the energy) are excluded. This definition of recycling includes primary, secondary, and tertiary activities and may not correspond to some definitions of the term.

material eventually becomes the resource for pallet recyclers. Next, the activities of two groups that are important in the recovery of pallets and pallet material are described: the new pallet industry (SIC 2448) and landfill operations. Finally, some products that are or can be made from recovered pallet material, including building products, are described.

Unless otherwise noted, the information in this paper regarding new wood use for pallets and containers and information regarding wood recovery by the pallet industry are based on the results of surveys conducted in 1993, 1994, and again in 1996. Estimates of industry totals were made using survey results and employment data provided by the Northeastern Forest Experiment Station, USDA Forest Service, Princeton, West Virginia.

Information regarding pallets at landfills was developed by the authors based on the results of a 1995 survey of all state licensed municipal solid waste (MSW) and construction and demolition (C&D) landfills in the United States (excluding Alaska and Hawaii). Please contact the authors for additional information regarding the study methods.

The resource: new wood use for pallets and containers

Wood is the predominant pallet material in North America; wood pallets command a market share of approximately 95 percent, and 97 percent of U.S. pallet producers manufacture only wood pallets (3). An estimated 4.82 billion board feet (BBF) of solid hardwood were used by the pallet and container industries (Standard Industrial Classifications 2441, 2448, and 2449) in 1993. Preliminary estimates by the Center for Forest Products Marketing indicate that this figure decreased to 4.48 BBF in 1995. We suspect that this change is due, in part, to increased use of recovered pallet material and was driven by increasing low-grade lumber prices and solid waste disposal costs. Figure 1 illustrates the trend in hardwood use for pallets and containers in the United States.

The latest year for which we have both total U.S. hardwood lumber production figures and estimates of hardwood use for pallets and containers is 1993. Hardwood lumber production is estimated to have been 10.5 BBF in 1993 (4). Using this figure, the pallet industry consumed in 1993 a volume of hardwood equal to 46 percent of production. It is likely that the corresponding figure for 1995 will be slightly lower than 46 percent due to increased lumber production and increased pallet recycling. Pallets, however, re-

mained the largest single use of hardwood lumber produced in the United States.

The pallet and container industries also use considerable volumes of solid softwoods. We estimate that consumption of solid softwoods was 2.12 BBF in 1993 (Fig. 1). While this level of softwood use is significant, it is not a large portion of softwood production. Estimated United States production of softwood lumber was 33.2 BBF in 1993 (4). Pallets accounted for 6 to 7 percent of this total. Preliminary estimates for 1995 indicate that the trend in new softwood use paralleled the trend in hardwood use between 1993 and 1995. That is, use of softwoods decreased, in this case from 2.12 BBF to an estimated 1.81 BBF.

Wood from many hardwood species is used for the production of pallets and containers. The general category of mixed hardwoods (hardwoods used without segregation by species) accounted for 41 percent of total hardwood lumber use in 1993. Oak was the most commonly utilized single species, accounting for 31 percent of total hardwood use for pallets and containers. Yellow-poplar had 12 percent and alder had 8 percent of total hardwood use in 1993. Softwood use for pallets and containers was dominated by the southern pine group (34% of total solid softwood use) and Douglas-fir (24%) in 1993.

The pallet and container industries use wood panels in addition to solid wood. While much of this use is for containers, panel deck pallets are also produced. Interest in this product appears to be growing. The

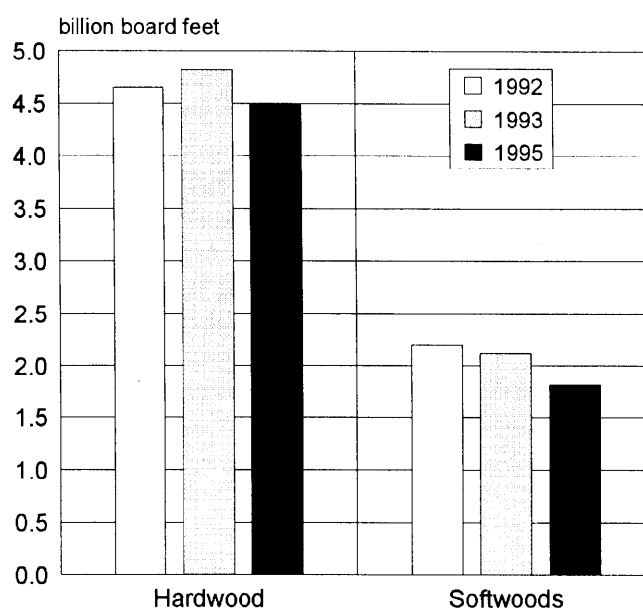


Figure 1. –Volumes of solid wood used for the production of pallets and containers in the United States.

major panel products used by these industries are softwood plywood and, to a lesser extent, oriented strandboard (OSB). We estimate that the industries used 187 million ft.² of softwood plywood and 20 million ft.² of OSB (3/8-in. basis) in 1995. Since 1992, the use of softwood plywood for pallets and containers appears to have grown; OSB use, however, appears to have remained relatively constant.

Utilizing the resource: pallet recycling

Pallet recycling occurs at several levels in the use cycle. Pallet users, new pallet manufacturers, “recycle only” businesses, and landfill operations are all involved in recycling. This study included two segments of this activity: recycling by firms in the industry (SIC 2448)² and recycling/reuse at landfills. While these segments do not account for all pallet recycling, they are important in terms of the number of pallets recovered for recycling.

Recycling by the pallet industry

Pallet recycling is not a new activity. In fact, the industrial recycling of pallets emerged in the 1960s and grew rapidly in the 1980s and 1990s. In his book, *Wood Pallet Manufacturing Practices*, Eichler states, “The pallet repair and recycling business has now become an integral part of the pallet industry” (2).

The National Wooden Pallet and Container Association reports that pallet recycling is now the most profitable sector of the pallet industry and a recent study (3) found that 41 percent of new pallet producers also recycle pallets.

Several factors have contributed to the recent, rapid growth of pallet recycling by the industry:

- Increased awareness of the environment and activities that affect the environment have caused a previously unconcerned public to question the use of new wood for pallets.
- Pallet producers, concerned with the availability and price of new lumber and cants, have found it economically advantageous to repair pallets and salvage material from used pallets.
- Pallet users have turned to recycled pallets as a way of decreasing their product handling costs.
- Pallet disposal costs can be significant and increasing attention is being paid to reducing or avoiding these costs.

²Standard Industrial Classification 2448 includes firms primarily engaged in manufacturing wood or wood/metal combination pallets and skids (one-sided pallets). This classification includes firms using new wood and firms using recovered pallet materials.

- Barriers to entry into pallet recycling are relatively low.
- Public concerns over the capacity and cost of landfills have resulted in some facilities banning pallets.

Firms in the pallet industry received an estimated 83.3 million pallets for recycling in 1993 (Fig. 2). The wood content of these pallets was estimated to be 1.24 BBF, 89 percent of which was eventually used again in a pallet. Preliminary estimates indicate that the number of pallets received by the industry in 1995 increased substantially to 171 million with a corresponding wood content of 2.6 BBF.

In 1995, 87 percent of the wood contained in pallets received for recycling was used again in a pallet. This figure includes pallets that were inspected, found not to need repair, and reused. The percentage also includes pallets that were repaired and reused, and the wood content of parts that were disassembled and used to repair pallets or build complete pallets.

In both 1993 and 1995 we found that 10 percent of the pallets received for recycling were ground or chipped. This material was used for products such as animal bedding, mulch, and furnish for composite products. A large portion of the ground pallet material (43% in 1995) was used as fuel.

Recycling at MSW and C&D landfills

Recycling by firms in the industry constitutes one portion of pallet recycling activity. This study investi-

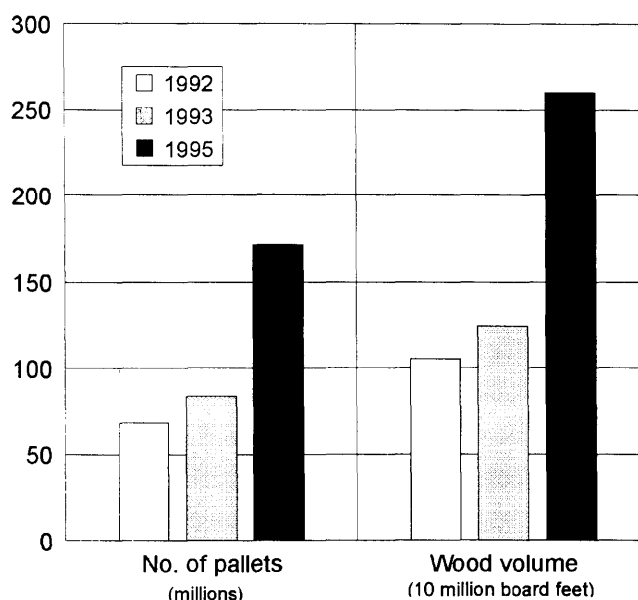


Figure 2.—Number and estimated wood content of pallets received by the pallet industry for recycling.

gated another portion by contacting over 1,200 MSW landfills and almost 600 C&D landfills selected from a list of all state licensed such facilities in the United States (excluding Alaska and Hawaii). Mail surveys and telephone contacts were used to collect data instead of direct examination of waste delivered to landfills.

Approximately 32 percent of responding MSW landfills and 33 percent of C&D landfills do not accept pallets for landfilling without some preliminary processing. However, 38 percent of MSW and 32 percent of C&D landfills operate a wood/yard waste processing facility. These facilities at MSW landfills processed 880.8 thousand tons of pallets in 1995. At C&D landfills, 161.9 thousand tons of pallets were processed. Pallets accounted for approximately 12 percent of the wood/yard waste processed at MSW facilities and 4 percent of wood/yard waste processed at C&D facilities.

The greatest amount of pallet material processed at landfills was ground for mulch, bedding, compost, soil amendments, or fuel (Fig. 3). Some pallets were used as fuel without grinding and some ground material was used as landfill cover. At MSW facilities, 3 percent of the pallets were recovered for reuse as pallets. At C&D facilities, 1 percent were repaired and reused and 12 percent were reused as pallets without repair.

Products from recovered pallets

Pallets can be and often are recycled into usable products. The predominant use for recovered pallet material by the segments studied is to build more pallets. Recycled pallets also result in fuel, mulch, and animal bedding products. In addition, there are interesting recycling opportunities for pallets that do not fall within the above categories, some of which have applications in construction and building. These can use either ground or solid pallet material.

Ground pallet material is being used as furnish for a variety of composite products. Wood composites include particleboard, hardboard, fiberboard, and insulation board. However, pallet material has little, if any, inherent advantage over other sources of furnish for these products (e.g., sawmill wastes and small diameter roundwood) and so must compete on the basis of relative delivered cost. Cost will undoubtedly influence the extent to which used pallets are utilized in the future. However, the influence of furnish cost might be mitigated if the recycled content of the products is promoted and customers value this feature.

Wood-plastic composites are also feasible using ground pallet wood. Ground pallets can, for example,

be added to recovered plastic to make "plastic lumber" for construction applications such as decks and docking. An example of this use is Trex™, a wood-polymer composite made from wood particles and recovered plastic grocery bags. A plant in Winchester, Virginia, currently uses ground pallet wood as well as wood from other sources (e.g., sawmill waste) to produce Trex™ plastic lumber.

A third group of products that can be made using ground pallet material are wood-cement composites. Current construction applications for this type of product include highway sound barriers and paving. Residential building applications are possible but may not be readily accepted in the United States.

Products that utilize pallet material in solid form are also feasible. In fact, it is possible to make almost any wood product from pallet wood if the economics are favorable. For example, furniture is manufactured from recovered pallet wood by Big City Forest™ in New York.

Because it utilizes relatively small cuttings, flooring holds perhaps the greatest potential as a high value-added product from pallet wood. Again, production is feasible (Big City Forest™ also manufactures flooring from recovered pallets) but the economic aspects of recovering pallet wood for this use are unknown. This question is currently under study by the scientists at the USDA Forest Service, Southern Research Station in Blacksburg, Virginia.

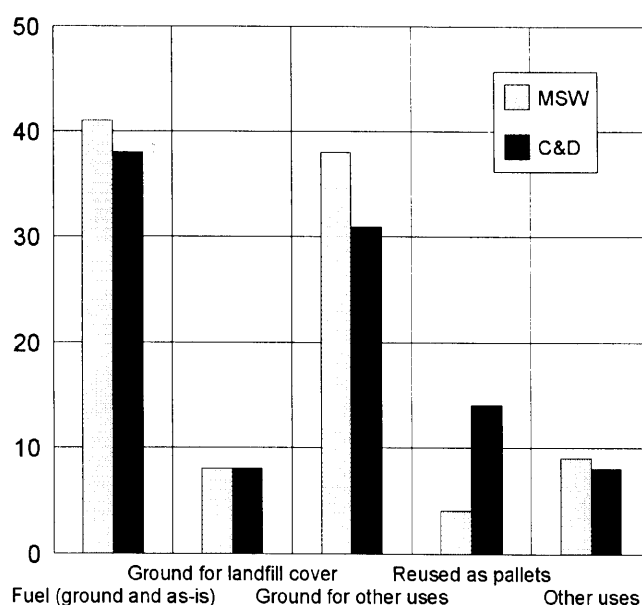


Figure 3.—Use of pallets received for recycling at municipal solid waste and construction/demolition landfills: 1995.

Literature cited

1. American Forest & Paper Association. 1994. 1993 Recovered Paper Statistical Highlights. AF&PA, Washington, D.C.
2. Eichler, J.R. 1976. Wood Pallet Manufacturing Practices. Eichler Associates, Cape Coral, Fla.
3. McCurdy, D.R. and J.E. Phelps. 1996. The pallet industry in the United States: 1980, 1985, 1990, and 1995. Dept. of Forestry, Southern Illinois Univ. at Carbondale, Carbondale, Ill.
4. Pease, D. A., T. Blackman, and J.A. Sowle. 1995. 1995-96 North American Factbook. Miller Freeman, Inc. San Francisco, Calif.
5. United States Environmental Protection Agency. 1994. Characterization of municipal solid waste in the United States: 1994 update. EPA530-R-94-042. U.S. EPA, Municipal and Industrial Solid Waste Div., Washington, D.C.